Annals of Clinical and Analytical Medicine
Original Research

The epidemiology of poisoning in emergency department in Turkey

Turkish toxicology report in emergency department

Cüneyt Arıkan, Ejder Saylav Bora, Güner Yurtsever, Osman Sezer Çınaroğlu, Hüseyin Acar, Tutku Duman Şahan, Fatih Esad Topal
Department of Emergency Medicine, İzmir Katip Çelebi University, Atatürk Research And Training Hospital, İzmir, Turkey

Abstract
Aim: Poisoning has a high potential mortality and morbidity. In order to prevent poisonings and reduce the risk of mortality and morbidity, it is necessary to determine the poisoning profile. Along with changes in medicine, technology and sociocultural life, the poisoning profile also changes over time. It is essential to keep up-to-date information on the subject in order to control poisoning.
Material and Methods: Poisoning cases admitted to the emergency department between 2016 and 2020 were retrospectively reviewed. Patients aged 18 years and older were included in the study. Patients younger than 18 years of age and those with missing data were excluded from the study. Demographic, etiological and clinical features of poisonings were analyzed.
Results: A total of 774 subjects with a mean age of 39.1±15.4 were included in the study. Of these subjects, 472 (61%) were male. The most common mechanism of poisoning was intentional exposures (n=418, 54%). It was known which substance 737 (95.2%) patients were exposed to, and a total of 1030 substances that caused poisoning were identified. Medications (n=579, 56.2%) were the first among the exposed substances, and antidepressants (n=152, %26.3) were the first among the medications. Poisoning with alcohol and its derivatives (n=282, 27.4%) was in the second place. The rate of hospitalization in the inpatient service was 50.8% (n=393), intensive care unit was 13.8% (n=107) and the mortality rate was 4.4% (n=34). The statistical significance between unintentional poisonings, the subjects who used antidote and the subjects who underwent hemodialysis and mortality was high (p values, respectively: $p<0.001$, $p<0.001$, $p<0.001$).
Discussion: This study is one of the that contain up-to-date information in large case series in the field of toxicology. Poisonings were most often caused by intentional exposure. Among the substances that cause poisoning, medications, alcohol and its derivatives are in the first two places. Hospitalization, ICU admission and mortality rates are high in poisonings, which creates a serious economic and social burden for the health system.

Keywords
Poisoning, Intoxication, Emergency Department, Antidote

DOI: 10.4328/ACAM.20917 Received: 2021-10-23 Accepted: 2021-11-11 Published Online: 2022-01-25 Printed: 2022-03-01 Ann Clin Anal Med 2022;13(3):279-282
Corresponding Author: Ejder Saylav Bora, Emergency Medicine, İzmir Katip Çelebi University, Atatürk Research And Training Hospital, İzmir, Turkey.
E-mail: saylavbora@hotmail.com / ejdersaylav@gmail.com P: +90 532 450 78 55
Corresponding Author ORCID ID: https://orcid.org/0000-0002-2448-2337

Introduction

Poisoning constitutes an important disease group in the emergency department (ED) with high potential mortality and morbidity [1]. The rate of admission to the ED with poisoning varies between 0.27% and 1.4% in Turkey [2,3]. This rate has been reported as 0.64% in United States [4], between 0.39% and 5% in European countries [5,6], and 0.82% in Taiwan [7]. Between 5% and 14% of intensive care unit (ICU) admissions are due to poisoning [8].

The cause of poisoning can be clearly identified in some cases, but sometimes it is very difficult to diagnose [1]. The causes and forms of poisoning can vary between countries, as well as between different geographical regions of the same country [9]. Determining the poisoning profile in a country or a particular region is crucial for identifying risks, taking necessary precautions, and managing cases [3]. In addition, the profile of poisoning may change over time with the effect of new treatment methods in modern medicine, advances technology, sociocultural changes. It is essential to record the cases and keep the relevant information up-to-date for the prevention and better management of poisonings [2].

In this study, it was aimed to determine the demographic, etiological and clinical characteristics of acute poisoning cases admitted to the ED.

Material and Methods

2.1. Study design and settings

This study was carried out in the adult ED of a tertiary health institution affiliated with the university in the city center of Izmir, with a population of 4.4 million, located in the west of Turkey. Poisoning cases admitted to the adult ED, which has an admissions of approximately 60,000 yellow and red coded patients (excluding trauma) annually, during the 5-year period between 'January 1, 2016-December 31, 2020' were analyzed retrospectively. Approval for the study was obtained from the Izmir Katip Çelebi University Non-Interventional Clinical Research Ethics Committee (Date 18.02.2021 and Decision No 0044).

2.2. Study population

Among the patients who presented to the ED, patients aged 18 years and older who had at least one of all the diagnostic codes containing the word "poisoning" (F10-19, T36-61, T96, X40-49, Y10-19, Y91) according to the International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) were included in the study. A total of 774 subjects were included in the study. Patients younger than 18 years of age and patients with missing data will be excluded from the study.

2.3. Data collection and processing

From the medical records of the subjects, age, gender, place of residence (province, district, countryside), time of admission to the hospital (hour, month and year), mechanism of poisoning (intentional, unintentional, adverse reaction and other) and type or name of the exposed substance, the number of exposed substances (single, two, more than two, unknown), the status of receiving counseling from a The National Poison Information Center (NPIC), the use and name of antidote, the need for hemodialysis, the hospitalization status, mortality and cost information were obtained. Subjects were divided into six groups according to age groups as 18-24, 25-34, 35-44, 45-54, 55-64 and ≥65. The time of admission to the hospital was grouped according to the year, month and time of the day of admission. The hours of the admission day are divided into daytime (08:00-15:59), evening (16:00-23:59) and night (00:00-07:59). The factors that cause poisoning are divided into 8 main groups as medications, recreational drugs, alcohol and its derivatives, gases, pesticides, bite/sting by animals, others (foods, corrosives, etc.) and unknown. Medications are divided into subgroups. These subgroups are psychotropic drugs, antidepressants, psychostimulant drugs, anticonvulsant drugs, analgesic and myorelaxant drugs, cardiovascular system drugs, gastrointestinal system drugs, antibiotics, antivirals and antifungals, vitamins, antihistamines, and others. (antidiabetics, hormones, herbal products, etc.) The cost of the subjects was calculated based on the Social Security Institution invoice.

2.4. Outcome measures

In this study, it was aimed to determine the most common causes of poisoning and the antidotes used in the ED. In addition, factors related to mortality and total costs of subjects were also calculated.

2.5. Data analysis

IBM SPSS Statistics 23 (SPSS Inc., Chicago, USA) program was used for data analysis. Descriptive statistics were expressed with frequency, percentage, mean and standard deviation values. The suitability of the data to the normal distribution was evaluated using the Shapiro-Wilk test, skewness-kurtosis values, and Q-Q plots. In the comparison of two independent groups, Independent Samples t-Test was used for data conforming to normal distribution. The chi-square test was used to compare two or more categorical groups. Values with p value less than 0.05 were considered significant. All statistics were performed at 95% confidence interval.

Results

In the 5-year period, in which approximately 300.000 yellow and red coded patients (excluding trauma) were admitted, the number of patients who presented to the ED due to poisoning was 774. Of these subjects, 472 (61%) were male. The mean age of the subjects who presented was calculated as 39.1±15.4, the mean age of men as 42.7±14.8, and the mean age of women as 33.5±14.7. Based on age groups, the highest number of subjects are between the ages of 25-34 (n=172, 22.2%) (Table 1).

Most of the subjects are living in the city center (n=621, %80.2). Most of the subjects presented during the daytime, between 08:00 and 15:59 (n=319, 41.2%). The highest number of presentations were made in 2018 (n=174, 22.1%), the least in 2020 (n=108, 14.0%). The months with the highest number of presentations are October (n=80, 10.3%), June (n=76, 9.8%) and February (n=74, 9.6%) (Graph 1).

The most common mechanism of poisoning was intentional exposure (n=418, 54%). A total of 1030 exposed substances causing poisoning were detected in 737 (95.2%) of 774 subjects. The cause of poisoning in 37 (4.8%) subjects was unknown. Of the subjects, 167 (21.6%) were poisoned with more than one substance and 71 (9.2%) were poisoned with

Table 1. Distribution by gender and age groups

Gender	n	%
Female	302	39.0
Male	472	61.0
Age groups		
18-24	163	22.1
25-34	172	22.2
35-44	150	19.4
45-54	152	19.6
55-64	93	12.0
≥65	44	5.7

Table 2. Mechanism of poisoning, type of poisons, poisoning with medications and number of exposed substance

Mechanism of poisoning	n	%	Poisoning with medications	n	%
Intentional	418	54.0	Antidepressants	152	26.3
Side effects	244	31.5	Analgesic-myorelaxant drugs	134	23.1
Unintentional	79	10.2	Psychotropic drugs	72	12.4
Other	33	4.3	Cardiovascular system drugs	61	10.6
Type of poisons			Antibiotics/antivirals/ antifungals	33	5.7
Medications	579	56.2	Anticonvulsant drugs	26	4.5
Alcohol and its derivatives	282	27.4	Gastrointestinal system drugs	20	3.5
Recreational drugs	58	5.6	Antihistamines	20	3.5
Bite/sting by animals	32	3.1	Psychostimulant drugs	19	3.5
Gases	23	2.2	Vitamins	14	2.4
Pesticides	14	1.4	Others	28	4.8
Other	5	0.5	Number of exposed substance		
Unknown	37	3.6	Single	607	78.4
			Two	96	12.4
			More than two	71	9.2

Table 3. Factors associated with mortality

	Mortality		p
	Yes	No	
Total [n (%)]	34 (%4.4)	740 (%95.6)	
Gender [n (%)]			
Female	10 (% 3.3)	292 (% 96.7)	0.240
Male	24 (% 5.1)	448 (% 94.9)	
Average age (Mean + SD)	44.4 ± 17.3	33.8±15.3	0.004
Mechanism of poisoning [n (%)]			
Intentional	15(% 3.6)	403(% 96.4)	<0.001
Unintentional	11 (% 13.9)	68 (% 86.1)	
Side effects	7 (% 2.9)	237 (% 97.1)	
Other	1 (% 3.0)	32 (% 97.0)	
Use of antidote [n (%)]			
Yes	19 (%10.9)	155 (%89.1)	<0.001
No	15 (%2.5)	585 (%97.5)	
Hemodialysis [n (%)]			
Yes	16 (% 18.4)	71(%81.6)	<0.001
No	18 (% 2.6)	669 (%97.4)	

SD= Standard Deviation

more than two substances (Table 2). Poisonings occurred mostly with medications (n=579, 56.2%), and among medications, antidepressants (26.3%) and analgesic - myorelaxant drugs (n=134, 23.1%) were the most common ones. Poisoning with alcohol and its derivatives (n=282, 27.4%) was the most common following medications (Table 2).

Among all poisonings, the most common cause was sucidal attempts (n=407, 52.6%). When the number of suicide attempts by months was analyzed, no significant difference was found (p=0.285).

NPIC was called for 469 (60.6%) of the subjects and counseling service was obtained. In total, specific antidotes were used 161 times for 127 (16.4%) subjects, and hemodialysis was applied to 87 (11.2%) subjects. The most commonly used specific antidotes were ethyl alcohol (n=46, 28.6%), oxygen (n=22, 13.7%) and fomepizole (n=21, 13.0%) .

The number of subjects treated in the ICU was 107 (13.8%), the number of subjects treated in the service was 393 (50.8%). The mean length of stay in the hospital (including the observation period in the ED) was 5.9±9.9 days, and the average cost per subject was calculated as approximately 1762.6±4787.6 TL.

Mortality due to poisoning occured in 34 (4.4%) of the subjects (Table 3). A statistically significant relationship was found between unintentional poisoning and mortality, one of the poisoning mechanisms (p<0.001). The statistical significance between the subjects who used antidote and the subjects who underwent hemodialysis and mortality was high (p values, respectively: p<0.001, p<0.001). In the mortality group, the mean age (44.4 ± 17.3) was found to be statistically significantly higher than the others (33.8±15.3) (p=0.004) (Table 3), but no statistical significance was found when looking at the age groups (p=0.210). No statistically significant was found between gender, poisoning time, exposure to more than one substance, duration of hospitalization and mortality (p values, respectively: p=0.240, p=0.603, p=0.886, p=0.487).

Discussion

Poisoning is a universal public health problem that especially threatens the young population. It constitutes an important patient group among critically ill patients admitted to the ED. This study is one of the rare studies that contain up-to-date information in large case series in the field of toxicology in Turkey [2,3].

The prevalence of poisoning cases admitted to the ED varies according to countries, regions, cities and hospitals [2-7]. In the present study, this rate was found to be 0.25% and it is similar to studies conducted in recent years [3,5].

In many studies conducted in Turkey and in the world, it has been reported that poisoning cases are more common in women [2-5]. The number of studies reporting that male subjects are in the majority is less [10]. In this study, the majority of subjects (61%) were male. Similar to other studies in the literature, the majority of subjects (63.7%) are adults between the ages of 18-45 [2-5].

It has been reported in previous studies that hospital admissions are most common in the hours before midnight [3,5]. In this study, the highest number of admissions was during the daytime hours between 08:00 and 15:59 (n=319, 41.2%). Looking at the number of cases by year, it is seen that the least number of cases is in 2020. This may be related to the significant decrease in the number of patients admitted to the hospital in the first period of the Covid-19 pandemic.

Among all poisoning cases, the most reported case as the

cause of poisoning was suicidal attempt [3,5] and in this study, the rate of suicidal attempt was found to be 52.6%. When the number of suicide attempts by months was analyzed, no significant difference was found (p=0.285). Subjects poisoned more than one exposed substance were 21.6% of all subjects. Poisonings occurred mostly with medications (56.2%). Among the medications, poisoning with antidepressants and analgesic-myorelaxant drugs take place in the first two ranks. Similar results were reported in two studies conducted with large patient groups in Turkey [2,3]. Although poisoning with alcohol and its derivatives (27.4%) and recreational drugs (5.6%) was found to be quite high compared to these two studies [2,3], it is similar to many studies conducted abroad [1,5,11,12]. Intoxication with alcohol and its derivatives and drugs is 3-7 times more common in male than in female [13]. In our study, male gender was detected more frequently. We think that this is due to the differences in the causes of poisoning. In addition to supportive treatment for poisonings, specific antidote treatments were administered to eligible subjects. Ethyl alcohol and fomepizole were at the top of the list of the most commonly used antidotes, similar to the high incidence of poisoning with alcohol and its derivatives.

Poison counseling centers are institutions that provide regional or country-wide services for poisoning. Doctors called NPIC in the study for 60.6% of the subjects and received consultancy service. This issue is one of the important points emphasized by the authors. We recommend calling poison control centers in all cases in order to contribute to obtaining more accurate and reliable data on a national scale and to get information about current treatment approaches.

A significant amount of the subjects admitted to the ICU consists of cases of poisoning. Mortality rates of 0.09-2.8% have been reported in previous studies [2,12,14]. In this study, the rate of hospitalization was 50.8%, the rate of admission to the ICU was 13.8%, and the mortality rate was 4.4%. When another study with similar hospitalization and ICU admission rates is examined, it is seen that the mortality rate was higher in this study [5]. This may be explained by the higher number of subjects (11.2%) who underwent hemodialysis compared to other studies [9]. Extracorporeal treatments such as hemodialysis are usually the treatment options used in high-dose or fatal toxicity situations where other treatment methods do not benefit [15]. When the factors that may be associated with mortality are evaluated, the significance of the mortality rate in unintentional poisonings is higher than in other groups. (p<0.001). This may be due to the inability to control the amount of the agent exposed in unintentional poisonings. The mortality rate was also statistically significant in subjects given specific antidote therapy and subjects underwent hemodialysis (p values, respectively: p<0.001, p<0.001). We think that this situation is related to high dose exposure.

The length and cost of hospital stay were also calculated. The mean hospital stay of the subjects was 5.9±9.9 days and the average cost to the healthcare system was calculated as 1762.6 ± 4787.6 TL. The psychosocial burden and losses caused by these cases on subjects, their relatives and healthcare workers are out of the scope of this study.

Conclusion

Poisoning especially threaten the young population. Hospitalization, ICU admission and mortality rates are high in poisonings, which creates a serious economic and social burden for the health system. The data obtained during present study can provide important and up to date information about the characteristics of poisoning cases seen in this region, and can guide the preventative actions for cases of poisoning. There is a need for more extensive and detailed studies across the country in order to better understand poisonings and raise awareness on this issue.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: *None*

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

References

1. Lam SM, Lau AC, Yan WW. Over 8 years experience on severe acute poisoning requiring intensive care in Hong Kong, China. Hum Exp Toxicol. 2010; 29(9):757-65.

2. Avsarogullari L, Senol V, Akdur O, Akin A, Durukan P, Ozkan S. Characteristics of acute adult poisonings in a university hospital emergency department in central Turkey: a three-year analysis. J Pak Med Assoc. 2012; 62(2):129-33.

3. Zöhre E, Ayrik C, Bozkurt S, Kose A, Narci H, Cevik I, et al. Retrospective analysis of poisoning cases admitted to the emergency medicine. Arch Iran Med. 2015; 18:117–122.

4. Gummin DD, Mowry JB, Beuhler MC, Spyker DA, Brooks DE, Dibert KW, et al. 2019 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 37th Annual Report. Clin Toxicol (Phila). 2020; 58(12):1360-1541.

5. Kristinsson J, Palsson R, Gudjonsdottir GA, Blondal M, Gudmundsson S, Snook CP. Acute poisonings in Iceland: a prospective nationwide study. Clin Toxicol (Phila). 2008; 46(2):126–32.

6. Schaper A, Ebbecke M. Intox, detox, antidotes - Evidence based diagnosis and treatment of acute intoxications. Eur J Intern Med. 2017; 45:66-70.

7. Chen CK, Chan YL, Su TH. Incidence of intoxication events and patient outcomes in Taiwan: A nationwide population-based observational study. PLoS One. 2020 23;15(12):e0244438.

8. Irwin RS, Rippe JM, editors. Irwin ve Rippe'nin Yoğun Bakım Tıbbı (6rd ed) 2014, (Çeviri Ed: Tulunay M, Cuhruk H). Ankara: Güneş Tıp Kitapevleri; 2014. p.1433.

9. Koylu R, Dundar ZD, Koylu O, Akinci E, Akilli NB, Gonen MO, et al. The experiences in a toxicology unit: a review of 623 cases. J Clin Med Res. 2014; 6(1):59-65.

10. Bjornaas MA, Hovda KE, Mikalsen H, Andrew E, Rudberg N, Ekeberg O, et al. Clinical vs. laboratory identification of drugs of abuse in patients admitted for acute poisoning. Clin Toxicol (Phila). 2006; 44(2):127-34.

11. Singh O, Javeri Y, Juneja D, Gupta M, Singh G, Dang R. Profile and outcome of patients with acute toxicity admitted in intensive care unit: Experiences from a major corporate hospital in urban India. Indian J Anaesth. 2011; 55(4):370-4.

12. Lund C, Teige B, Drottning P, Stiksrud B, Rui TO, Lyngra M, et al. A one-year observational study of all hospitalized and fatal acute poisonings in Oslo: epidemiology, intention and follow-up. BMC Public Health. 2012; 12:858.

13. Fiscella K, Noonan M, Leonard SH, et al. Drug- and Alcohol-Associated Deaths in U.S. Jails. J Correct Health Care. 2020;26(2):183-193

14. Goksu S, Yildirim C, Kocoglu H, Tutak A, Oner U. Characteristics of acute adult poisoning in Gaziantep, Turkey. J Toxicol Clin Toxicol 2002; 40: 833-7.

15. Ouellet G, Bouchard J, Ghannoum M, Decker BS. Available extracorporeal treatments for poisoning: overview and limitations. Semin Dial. 2014; 27(4):342-9.

How to cite this article:

Cüneyt Arıkan, Ejder Saylav Bora, Güner Yurtsever, Osman Sezer Çınaroğlu, Hüseyin Acar, Tutku Duman Şahan, Fatih Esad Topal. *The epidemiology of poisoning in emergency department in Turkey. Ann Clin Anal Med 2022;13(3):279-282*